NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Climate City Contract

2030 Climate Neutrality Action Plan

2030 Climate Neutrality Action Plan

of the City of Porto

Porto.

NetZeroCities has received funding from the H2020 Research and Innovation Programme under the grant agreement n°101036519.

Executive Summary

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The Porto's Climate Neutrality Action Plan presents a holistic strategy for achieving carbon neutrality by 2030, emphasizing collective action, systemic approaches, and inclusivity. **The city targets an 85% reduction in greenhouse gas (GHG) emissions from 2019 levels, with the Porto Climate Pact driving citizens and organizations (currently, it has 538 individual subscribers and 228 institutional subscribers) to action and to create a large community of learning, sharing, and mutual support.** Despite challenges in attracting private investment and stimulating substantial behavioural and habit changes, the City Executive believes that a common vision and goal for decarbonization can help all stakeholders move in the same direction.

This Action Plan begins with an evaluation of the city's current state of climate action, including a **detailed GHG baseline inventory managed by Agência de Energia do Porto (AdEPorto). In 2019, Porto emitted 937 ktCO2eq, primarily from buildings, followed closely by transports, and then waste.** Unlike industrial territories, Porto's emissions from Industrial processes and product use (IPPU) are relatively low. Despite over one-third of the city being urban green areas, recent studies indicate that Porto has a notable capacity for carbon sequestration. Knowing where the city stands in terms of energy consumption and GHG emissions is decisive to develop a solid Climate Neutrality Action and Investment Plans considering the actions being promoted by both the Municipality and by other city stakeholders.

Responding to the climate emergency, Porto, recognized as one of the 100 European carbon-neutral Mission Cities, launched the Porto Climate Pact in January 2022. Within this framework, a pivotal step was taken to consolidate the city decarbonization efforts with the creation of Porto's Transition Team, formed by 11 entities including municipal departments, companies, agencies and private entities, with a formalized commitment through the agreement "Towards Carbon Neutrality 2030". This collaborative effort emphasizes breaking down silos, fostering interdisciplinary cooperation, and addressing multifaceted challenges to achieve carbon neutrality by 2030.

Acknowledging governance barriers and multilevel governance hurdles, **Porto actively participates in a national network to align local objectives with central government policies**. Systemic barriers across sectors are identified, and a collaborative approach, including initiatives like the **Porto Climate Pact Talk Series dedicated to discussing carbon neutrality issues through a series of sessions addressing the challenges faced by the city of Porto, is adopted to enhance understanding and participation.**

In line with Porto's 2030 Climate Neutrality Commitments, **the Action Plan clearly identifies the impact pathways and strategic portfolio of actions which prioritize expanding green infrastructure, enhancing mobility options, adopting clean energy, and promoting circular practices.** Actions include doubling garden and park areas for carbon sequestration, reducing motorized transportation, promoting shared mobility and electrifying vehicles, emphasizing sustainable transportation goals. The energy system focuses on clean energy sourcing, renewable generation, and energy efficiency, while waste and circular economy actions target increased recycling and efficient processes.

Overall, Porto is committed to an 85% emissions reduction target by 2030. This means that the percentage of emissions reduction previously planned through other Action Plans already in progress represents 35% of this target, while the rest of the emissions reduction expected through this CCC Action Plan represents 50%**. Therefore, 416 ktCO$_{2eq}$ represents the emissions gap which will be**

addressed through the comprehensive portfolio of actions defined in these CCC Action Plan. Residual emissions represent 121 ktCO_{2eq} coming mainly from transport and waste sectors. The plan emphasizes collaboration between municipal and private stakeholders through the Porto Climate Pact, reflecting a continuous and inclusive engagement in the climate neutrality process.

Regarding monitoring and evaluation of the Climate City Contract (CCC) and its Action Plan, **a comprehensive set of key indicators are identified and a robust plan to track progress is developed establishing a baseline (2019), a plan for carrying out routine monitoring (on a yearly basis), and mid-term (2025 and 2027) and final (2030) evaluations.** These indicators measure the outcome(s) or impact(s) of one or more of the actions in this Action Plan and show how close an action is to the desired pathway and targets.

In terms of governance, Porto's model is centred around the Porto Climate Pact and managed by the Transition Team, demonstrating a collaborative and inclusive effort involving citizens and various stakeholders, both public and private, to achieve carbon neutrality. **Beyond the goal of decarbonization, Porto also aspires to ensure a fair transition that actively engages its citizens** with several different projects and other initiatives related to Porto Climate Pact. However, challenges arise at the national level, impacting regulations, funding, and alignment with central government policies.

In its determination to **build a city that is resilient in the face of challenges, socially inclusive in its opportunities, and environmentally conscious in its development, Porto's social innovation projects and interventions are essential**. They mainly incorporate entrepreneurship incubators, awareness campaigns, and circular economy initiatives, as a forward-thinking, community-centric model for urban development.

Looking ahead, Porto plans a thorough review of the CCC in the next two years, outlining steps for climate strategy refinement, stakeholder engagement and a tailored monitoring strategy. **These steps aim to align actions, enhance citizens and stakeholder involvement, ensure effective monitoring, and adapt the CCC to Porto's unique climate journey**. Through this iterative process, Porto seeks to attract resources, monitor progress, and achieve its vision for a sustainable and resilient future by 2030.

March 2024

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Abbreviations and acronyms

Abbreviations and acronyms	Definition
ADENE	Portuguese Energy Agency
AdEPorto	Porto Energy Agency (Agência de Energia do Porto)
AE FEUP	Students Association of Porto's Engineering Faculty
AEFEP	FEP Student Association
AFOLU	Agricultural, Forestry and Land Use
ANCV	National Green Roofs Association (Associação Nacional de Coberturas Verdes)
ANI	National Agency for Innovation

BaU	Business-as-Usual
BE	Built Environment
BREAM	Building Research Establishment Environmental Assessment Method
BRT	Bus Rapid Transit
CCC	Climate City Contract
CCUS	Carbon Capture, Utilization and Storage
CDP	Disclose Insight Action (previous Carbon Disclosure Project)
CDW	Construction and Demolition Waste
CEIIA	Centre of Engineering and Product Development
CH4	Methane
CIRIS	City Inventory Reporting and Information System
CITTA	The Research Centre for Territory, Transports and Environment (Centro de Investigação do Território Transportes e Ambiente)
CNAP	Climate Neutrality Action Plan
CNIP	Climate Neutrality Investment Plan
CO	Carbon Monoxide
CO2	Carbon Dioxide
dB	Decibel
DGEG	Directorate General for Energy and Geology
DSO	Distribution System Operator
EC	European Commission
ELPCPE PT	National Long-Term Strategy to Fight Energy Poverty
ELPRE PT	Long-Term Strategy for Building Renovation in Portugal
ENAAC	National Strategy for Adaptation to Climate Change
EN-H2	National Strategy for Hydrogen
EOI	Expression of Interest
EPC	Energy Performance Contracting
eq	Equivalent
ES	Energy Systems
EU	European Union
EUCF	European City Facility
EU-SILC	EU statistics on income and living conditions
EV	Electric Vehicles
EY	Ernest & Young
FDI	Foreign Direct Investment
FEP	Faculty of Economics of the University of Porto
FEUP	Faculty of Engineering of the University of Porto (Faculdade de Engenharia da Universidade do Porto)
GDP	Gross Domestic Product
GEMINI	Greening European Mobility through cascading innovation INItiatives
GHG	Greenhouse Gases
GI	Green Infrastructure & Nature-based Solutions
GPC	Global Protocol for Community-scale GHG Emission
GWh	Gigawatt hour
GWP	Global Warming Potential
H2	Hydrogen
H2020	Horizon 2020
ha	Hectare

HORECA	Food Service and Hotel Industries
HVAC	Heating, Ventilation, and Air Conditioning
ICESD	Domestic Energy Consumption Survey
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and Communications Technology
IDC	International Data Corporation
IMI	Municipal Property Tax
IN+	Center for Innovation, Technology and Policy Research
INEGI	Institute of Science and Innovation in Mechanical and Industrial Engineering (Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial)
inhab.	Inhabitants
IoT	Internet of Things
IP	Infraestruturas de Portugal
IPCC	Intergovernmental Panel on Climate Change
IPO	Instituto Português de Oncologia
IPPU	Industrial Processes and Product Use
ISEP	Superior Engineering Institute of Porto
kg	Kilograms
km	Kilometres
kt	Kilotonnes
kWp	Kilowatts-peak
LBC	Portuguese Climate Law
Lden	Day-evening-night Noise Indicator
LED	Light-emitting Diode
LEED	Leadership in Energy and Environmental Design
LIPOR	Association of Municipalities for the Sustainable Waste Management of Porto
Lnight	Night-time Noise Indicator
LPG	Liquefied Petroleum Gas
M&E	Monitoring & Evaluation
M&T	Mobility & Transport
M€	Million Euros
MaaS	Mobility as a Service
MAP	Mercado Abastecedor do Porto
MEL	Monitoring, Evaluation and Learning
MOBI.E	Portuguese Electric Mobility Management Entity
MSW	Municipal Solid Waste
MW	Megawatts
MWh	Megawatts-hour
MWp	Megawatts-peak
N2O	Nitrous Oxide
NGOs	Non-Governmental Organizations
NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NZC	NetZeroCities
NZEB	Nearly Zero-Emission Building
O3	Ozone
P-3AC	Programme of Action for Adaptation to Climate Change
PAMUS	Porto's Sustainable Urban Mobility Plan
PAPERSU	Municipal Action Plan for Urban Waste Management

PART	Public Transport Fare Reduction Support Program
PCED	Positive Clean Energy District
PDIP	Porto Public Lighting Master Plan
PDM	Municipal Master Plan
PEER	Porto Energy ElevatoR
PERSU	Urban Waste Strategic Plan
PIH	Porto Innovation Hub
PLUS	Plan for Sustainable Logistics
PM10 or PM2.5 particles	Particles with a diameter equal to or less than 10 µm and 2.5 µm
PNEC	National Energy and Climate Plan
PNGR	National Waste Management Plan
PNPOT	National Spatial Planning Policy Program
POSEUR	Operational Program Sustainability and Resource Use Efficiency (Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos)
PQAP	Porto Fifth Façade Project (Projeto Quinto Alçado do Porto)
PV	Photovoltaic
REC	Renewable Energy Communities
RNC2050	2050 Roadmap to Carbon Neutrality
RNT	Non-Technical Summary
RRF	Resilience and Recovery Funds (Plano de Recuperação e Resiliência)
SEAP	Sustainable Energy Action Plan
SMOS	Sistema de Monitorização da Ocupação do Solo
SO2	Sulfur Dioxide
STCP	Public Transport Company of Porto (Sociedade de Transportes Coletivos do Porto)
t	Tonnes
T&D	Transmission and Distribution
TIC	Campanhã Intermodal Terminal (Terminal Intermodal de Campanhã)
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCI	Via de Cintura Interna
WAKE UP!	Wider Approach to Keep Engaged citizens on sustainable Urban Policies
WCE	Waste & Circular Economy
WWTP	Wastewater Treatment Plants

1 Introduction

Introduction

The stability of the global climate system is at risk as a result of the high concentration of Greenhouse Gases (GHG) in the global atmosphere. Mitigating these emissions is urgently needed to avoid unpredictable consequences on the natural, economic, and social systems. The European Union (EU) has been leading the way: Member States should set a target of 55% reduction in 2030 and neutrality in 2050. At a national level, the Portuguese Climate Law sets a reduction in emissions of at least 55% by 2030, 65% to 75% by 2040, and 90% by 2050. **Indeed, in parallel with the drafting of its Climate City Contract, as a Mission City, Porto is also drafting its Municipal Climate Action Plan to respond to the national Climate Law, seeking to align both documents and showing a higher ambition than the national one.** Reducing GHG emissions to reach carbon neutrality requires bold measures and high public and private investment as well as a comprehensive engagement of all city stakeholders, from the Municipality to the private sector, academia, NGOs, and citizens. At the same time, this city transformation represents an opportunity for competitiveness, employment, and social justice.

Driven by its determination to lead by example and become a reference in climate neutrality, **Porto committed to accelerate carbon neutrality by 2030, reducing its greenhouse gas (GHG) emissions by 85%, compared to 2019.** This ambition was firstly expressed in 2021 in the Expression of Interest (EOI) to the '100 Climate neutral and Smart Cities' Mission and since then, the city has been diligently working on this commitment.

-85%

Porto's ambition to reduce GHG emissions by 2030 (compared to 2019)

Porto is the epicentre of a region with more than 1,7 million inhabitants – the Metropolitan Area of Porto, being the 4th most populous Portuguese Municipality and the 3rd most densely populated in the country. Porto city, which is the entire Municipality of Porto, is small compared to its metropolitan area, with an estimated population of just 231 800 people (in 2021) in a Municipality with only 41,42 km^2. Located along the Douro River estuary in northern Portugal, Porto is one of the oldest European centres, its historic centre was proclaimed a World Heritage Site by UNESCO in 1996, and the western part of its urban area extends to the coastline of the Atlantic Ocean.

In the last few decades, the city is getting more attractive for living, studying, and hosting businesses. Indeed, one in every five startups nationwide are in Porto and the city's connection to academia and research centres contributed to the creation of a hub known for generating, attracting, and retaining knowledge. Also, over the last few years, Porto has experienced significant tourism increase, which may be partly linked to the Ryanair hub at Francisco de Sá Carneiro Airport, located in the vicinity of the city. Indeed, Porto won the European Best Destination 2012, 2014 and 2017 awards and several other prizes in the World Travel Awards.

Since 2009, when it became the first Portuguese city to subscribe to the Covenant of Mayors (and one of the first five European cities), Porto has been designing a transformative way to develop a low-carbon, sustainable and inclusive city, leading by example and setting the standards for other national and European cities, while putting citizens and local stakeholders at the centre of this city transformation. This way of working and thinking has led to Porto, the second Portuguese city and the capital of the country's northern region, being selected to be part of the group of European cities that aim to achieve carbon neutrality by 2030.

This Climate City Contract is directly in line with Porto's Sustainable Energy Action Plan (SEAP), developed under the scope of the EU Covenant of Mayors, and whose goal was to achieve a GHG reduction of 60% by 2030, compared to 2004. By increasing the reduction target, the measures foreseen in the city SEAP (and included in this action plan) were revised and further strengthened. **Also, this Action Plan is fully aligned with the Municipal Climate Action Plan** in development under the scope of the National Climate Law whereas the Climate Neutrality Investment Plan builds partially on the Investment Concept developed by Porto under the scope of the European City Facility (EUCF) initiative. Also, to ensure the city's systemic change, **Porto's Climate City Contract builds on the Porto Climate Pact, a central piece of the city strategy towards neutrality and the merging element boosting all agents to act in favour of carbon neutrality.**

Figure 1. Link between CCC components and Porto's strategic plans.

By having a clear idea of how energy is used in the city and how emissions are evolving in the territory over time (the city inventory of GHG emissions cover the entire administrative territory, sectors, sources and scopes, excepting AFOLU (Agriculture, forestry, and other land use) as Porto is a purely urban area, without agricultural activity, **Porto knows that the path towards carbon neutrality in Porto is demanding and calls for collective action and demands a systemic approach where all city elements must act collaboratively, realizing the interdependencies and synergies between them and the city government**. Also, Porto realized that no matter how aligned and committed the Executive may be with this objective, it cannot drive this transformation alone. Therefore, the diversity of Porto's ecosystem should be invited to participate and act in the city transformation. In this sense, to activate and foster an inclusive climate transition, in 2022, the Municipality launched the **Porto Climate Pact with a clear rationale: *The path towards carbon neutrality is demanding and calls for collective action*.** The City Executive believes that a common vision and goal for decarbonization can help all stakeholders move in the same direction. Therefore, the Porto Climate Pact intends to involve citizens and organizations to action and to create a large community of learning, sharing, and mutual support. The signing of the Pact is voluntary, non-binding, free of charge and everyone is invited to join in and, currently, it has 228 institutional subscribers and 538 individual subscribers (citizens).

Figure 2. Porto Climate Pact launch event.

In 2022, within the framework of the Porto

Climate Pact, a pivotal step was taken to consolidate the city decarbonization efforts. **An internal team, comprising diverse entities, from various municipal departments, municipal companies, and agencies, formally coalesced to spearhead the city's decarbonization strategy**. This collaborative effort, now known as **Porto's Transition Team**, had been informally collaborating for years, but now solidified their partnership through a formal agreement titled "Towards Carbon Neutrality 2030". This landmark agreement, signed by 11 entities, underscores a commitment to allocate human resources towards a shared vision of sustainability governance. This team encompasses therefore core competencies geared towards achieving carbon neutrality by 2030 and integrates:

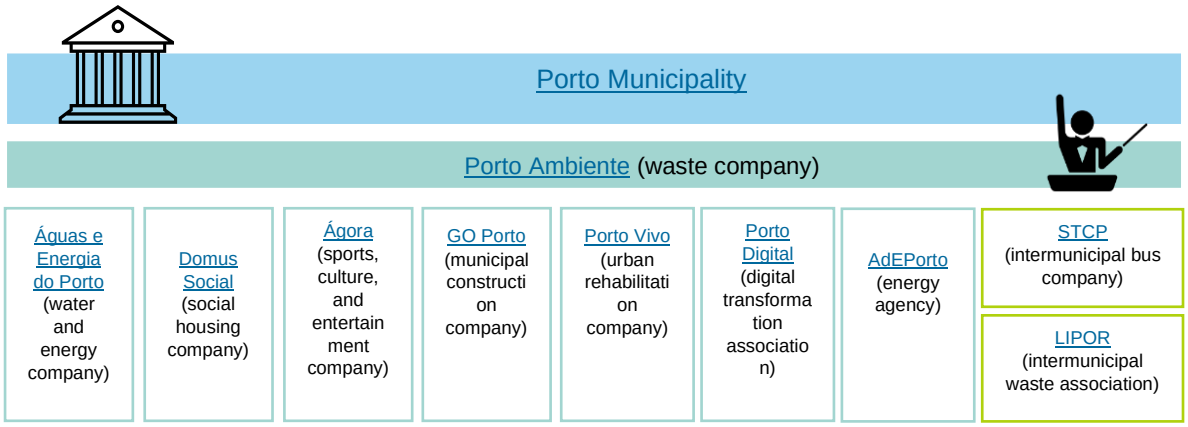


Figure 3. Porto Transition Team structure.

This initiative showcases not only the direct involvement of various Porto Municipality Departments but also strong engagement from municipal companies/agencies and private companies responsible for the city decarbonization efforts. These include the energy agency, water and energy management, waste collection and management, digital transition and transformation, public transport, social housing, and municipal buildings management, among others. **This collaborative effort emphasizes the importance of breaking down silos and fostering interdisciplinary cooperation across sectors to ensure a holistic approach to the city's transition and effectively address the multifaceted challenges of achieving carbon neutrality by 2030**.

To support this agreement, the Porto Municipal Assembly approved a formal mandate to Porto Ambiente to orchestrate the municipal efforts towards carbon neutrality. With a dedicated team to coordinate these efforts, there is a **Carbon Neutrality Department** to align these activities under the political portfolio and leadership of Mr. Filipe Araújo, Vice-Mayor of Porto, the main sponsor of Porto Climate Pact. This ensures a strong political alignment and commitment to make carbon neutrality by 2030 a reality and, especially, to ensure its importance and relevance for the future.

This integrative and growing dynamic of the Porto Climate Pact maintains continuous communication with its network of subscribers, **primarily using the Porto Climate Pact website as the main contact point and information dissemination medium**. This website features a section that is consistently updated with news from the numerous subscribers, aiming to disseminate and publicize results and best practices that can engage the community and create contagious dynamics of knowledge within the broader community. This constantly updated section can be accessed at the Pact website in both Portuguese and English versions.

One of the first priorities of this team was to map the universe of city actors with an impact on decarbonization, identifying its protagonists, their roles, and interrelations. This mapping allows the creation of lasting relationships between city actors and the design of co-creation processes between such entities in a fertile environment for new ideas and experimentation, allowing the development of a shared vision of the city. In fact, several of the biggest city energy and sustainability projects resulted from collaborations between different city entities (see Box 1 and Box 2).

BOX 1: Collaborative projects

Porto Solar: Resulted from the idea developed collaboratively between the Municipality and Domus Social, with the technical support from the AdEPorto and which resulted in the installation of 1MW$_p$ of photovoltaic energy in 29 public facilities.

BOX 2: Collaborative projects

ASCEND project: With the participation of Águas e Energia do Porto, Porto Digital Association, AdEPorto and Serralves Foundation, the HORIZON EUROPE ASCEND project will develop the first positive clean energy district in the city.

To strengthen the climate transition mandate, the full city ecosystem of actors needs to be positively engaged and, although there is currently a clear idea of the roles and relationships between everyone, it is necessary to involve citizens and make them active actors in the city transformation. In this domain, Porto has developed structural processes that aim to involve citizens in decision-making and in the implementation of public policies to achieve a fairer and more sustainable city. Regarding citizen participation, Porto has been promoting the creation of various mechanisms for consultation and dialogue with citizens, mainly through the creation of events for public participation. In this way, it seeks to foster citizen co-responsibility in the management of the city, and to promote transparency and accountability. **Accordingly, Porto has been developing several citizen-centred approaches, promoting the integration of different profiles.** The following three examples reflect the identification of challenges and the strategies that have been created as opportunities to include everyone:

- In a broader approach, it became necessary to create a joint effort, combined with the sense of community that is so characteristic of Porto. This is how the Porto Climate Pact came about, integrating everyone in this joint effort and which, in addition to institutions, already has more than 500 individuals as signatories who are now more aware of the environmental cause and the need for action. The Porto Climate Pact maintains continuous communication with its network of subscribers, primarily using the Porto Climate Pact website as the main contact point and information dissemination platform. This website features a section that is consistently updated with news from the numerous subscribers, aiming to disseminate and publicize results and best practices that can engage the community and create contagious dynamics of knowledge within the broader community.

- The Transition Team also realized the need for a more personalized approach. For this reason, the Porto Climate Pact Talk Series was design to bring citizens and experts together

to debate ten essential topics for the climate transition. For nearly three months, the carbon neutrality issue was discussed in a talk series that debated the themes of climate change and the challenge of decarbonizing the city of Porto. These sessions, held weekly, at the Porto Innovation Hub, brought together more than 500 participants and 40 speakers. In each of the 10 sessions, the formula was constant: a moderator led a conversation between several guest speakers, experts on different topics, in a healthy sharing of good practices, ideas and ambitions about the topic of the session that inspired those present and gave clues about the way forward for the future. Decentralized and clean energy, sustainable mobility, decarbonization of construction, the circularity of the food system, community involvement, carbon sequestration, the challenges of a just transition, the importance of data, financing and nature-based solutions were the motto of the different sessions that convened figures from academia, the business sector, public organizations, and industry associations for discussion. The sessions, open to the public, were guided by the dynamics of interaction between speakers and audience, always challenged to make suggestions, questions, or make comments on the topics addressed. The interest shown by those present demonstrates the importance of the topic for civil society and is evident in the growing number of subscribers to the Pact. The Talk series discussions are available on the Porto Climate Pact website, with videos of the sessions, written highlights as well as in podcast format on the main platforms. These sessions, held on Porto Innovation Hub (PIH), the innovation heart of the city, were key to engage citizens in the city decarbonization process, and to show them the set of projects being developed in Porto. Indeed, the success of these sessions inspired the Transition Team to consider this tool as one of the axes for promoting citizen participation in the city's decarbonization process during the next years. Similarly, training and co-creation sessions are planned in the Municipality's parish councils, promoting a community approach to the issue, the search for solutions based on the reality experienced locally and benefiting from everyone's participation due to the geographical proximity and the positive pressure everyone can exert on their neighbours to raise awareness and increase participation.

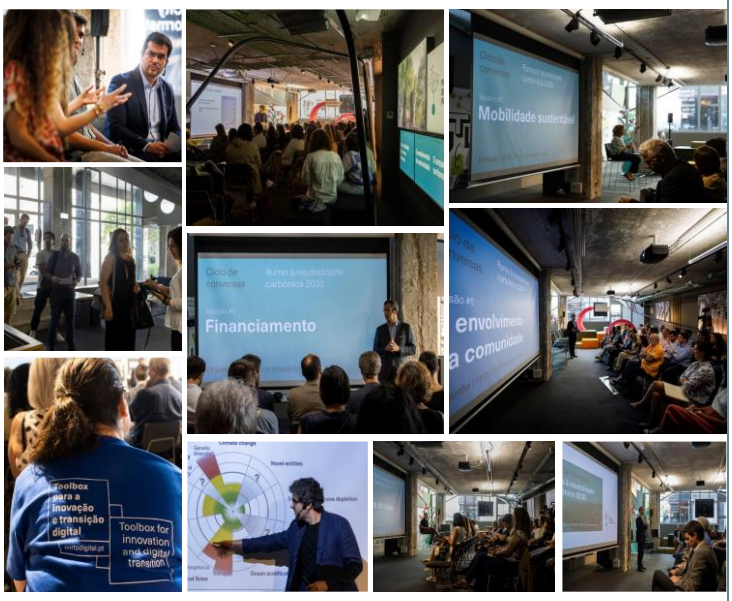


Figure 4. Porto Climate Pact Talk Series.

- To further continue this effort of engaging citizens in the city decarbonization path, Porto aims now to start to build an integrated approach merging technology and information to place citizens at the centre of the city climate action. This aim was applied to the NetZeroCities Pilot Cities Programme and the project "WAKE UP!" (Wider Approach to Keep Engaged citizens on sustainable Urban Policies) will now develop a digital engagement tool. WAKE UP! aims to develop a broader set of services provided by multiple city partners whilst raising citizens awareness and promoting the adoption of sustainable-friendly behaviours. The overall idea is to use an app associated with Card Porto. to allow citizens to track their carbon footprint

and access tips to reduce it while being rewarded for sustainable behaviours. This idea was submitted and approved to the NZC Pilot Cities Programme Cohort 2 and is understood as a key initiative to engage citizens and promote the so-desired behavioural change in the local population. Porto's city management model also prioritizes people, especially vulnerable groups, involving them in the sustainable development journey. Looking globally, it is clear that the most vulnerable populations are typically those who suffer the most from climate change, and in large urban centres this reality persists.

For a fair climate transition where no one is left behind and equitable access to opportunities are provided, Porto's strategies include increasing literacy and supporting citizens in mitigation but also in adaptation measures. Aligned with this, examples of mitigation measures are:

- The substantial investments in the renovation of social housing that have been made to enhance the quality and the energy efficiency of residential buildings. The Municipality of Porto has allocated more than 150 million euros in the last decade to fund these renovation projects. By upgrading social housing, Porto not only improves living conditions for its residents but also contributes to a reduction in energy consumption and environmental impact.

- Another noteworthy measure in Porto's climate mitigation strategy involves providing free public transport passes to Porto Card users under the age of 18, since 2019 until 2023. In 2024, this initiative will be financially supported by the national government taking on the funding responsibility. By offering free transportation to young residents, Porto encourages the use of public transit, reducing reliance on individual vehicles and, consequently, lowering carbon emissions. From 2024 onwards, the municipality's budget will provide 22 free public transport trips to all Porto Card users, a new incentive for urban transport in the city.

Interventions related to adaptation to climate change for the most vulnerable citizens are also relevant to guarantee a fair and just climate transition. Related to adaptation two concrete examples of measures that aim to reduce the impacts of climate change, are presented as follows:

- The homeless population is the most exposed to extreme weather conditions, phenomena that have been occurring more frequently in the city. With this in mind, Porto has developed a Cold Weather Contingency Plan for Homeless People which guarantees shelter and overnight stays in closed, heated spaces.

- Also, heavy rainfall events have become increasingly frequent in Porto, leading to disturbances in the city. During one of this events, part of the eastern area of the city, in "Ilha dos Moinhos – Fontainhas" has been particularly affected forcing the evacuation of families. The Municipality has found an effective solution to the problem by having relocated the families, acquired the land and developing a green area in which nature-based solutions will be implemented to absorb abundant rainfall water.

These are some examples of measures that are also being reflected in the Municipal Climate Action Plan, which is currently being developed alongside with the update of the Municipal Climate Change Adaptation Strategy.

Also, Porto focus on the engagement of vulnerable people during the city decarbonization. One example of citizen involvement that the Municipality has been working on is the **URBiNAT project**, in which Porto is one of the participating cities and which seeks to create "healthy corridors" in the parish of Campanhã, one of the city's most vulnerable areas. In the scope of this project, this area has been targeted by several investments with a view to improve the liveability of three social housing neighbourhoods through the deployment of cocreation processes involving the citizens who work and live in the parish of Campanhã, organisations and schools. These moments came in various formats, such as awareness-raising activities, talks, workshops, digital contents, and games, with around 150 participants. A set of immaterial and material initiatives were co-developed. That includes a four-hectare green park is now under construction in the location (Park Alameda de Cartes included in Porto's Action Plan) and which will incorporate nature-based solutions, complemented by educational, environmental, and socio-economic initiatives, all co-designed and co-developed by the local community.

Figure 5. Co-creation sessions with citizens in the scope of the URBiNAT project.

As part of the **Porto Orgânico project,** which aims to improve the collection and management of biowaste in the city, Porto created two community composting islands that are available for citizens to dispose of their organic waste. The two islands are located in different housing neighborhoods in the city and everyone who lives nearby can participate. The project provides initial knowledge on organic waste separation and a kit with a bucket for collecting food waste, a key to access the composter, a vertical garden and a rucksack. Participants can count on the support of technicians on the field, who oversee and monitor the entire composting process. The result is a 100 % natural organic compost, which is made available to project members. In less than two years, 151 families have contributed to the project, which has enabled more than 7,6 tonnes of biowaste to be recovered, resulting in more than 2 tonnes of compost distributed to the participating families.

This project is the result of a collaboration between LIPOR and the municipal company Porto Ambiente. The implementation of these two community composting sites stems from the work carried out as part of the City Loops project, funded by the Horizon 2020 (H2020) research and innovation framework programme. Community composting has emerged as a solution for the local treatment of biowaste, making it possible to reduce costs and also reduce the associated environmental impacts. This is a project that actively involves citizens in the management of their own waste, boosts the circularity of these resources and allows for the reduction of the individual environmental impact.

Figure 6. Community composting island.

Also under development is the **"ComEC0" project**, which has emerged as a quest for greater citizen involvement, with the aim of involving and training entry managers from the city's social housing neighbourhoods to promote sustainable practices in vulnerable communities, with an emphasis on literacy for sustainability. This project has the potential to positively impact part of the approximately 950 entry managers, spread across the 44 social housing groupings, as part of Domus Social's ConDomus programme, which aims to involve tenants in the management processes of the common spaces in municipal buildings, similar to what happens in a conventional building complex. One of the goals of this initiative is to develop a playbook, which will be the result of a close collaboration with municipal organisations specialising in a wide range of areas, to promote more responsible, conscious, and greener knowledge and practices. This document will empower entry managers, providing them with the necessary skills for a more positive impact and for passing on knowledge to their peers.

Actions such as practical and interactive workshops will be organised, covering topics such as waste-free cooking, reuse and the circular economy, energy, and water efficiency, for example. The experience will be gamified, establishing a closer relationship between the community and the Municipality, facilitating learning and the adoption of sustainable practices. This project aims to create a direct relationship between the economic and environmental aspects associated with sustainability, while also making a clear contribution to the social pillar. By correlating the economy and the environment, the aim is to encourage more sustainable behaviours, showing that conscious attitudes positively influence not only the individual's environmental impact, but also the city's quality of life. The project establishes an essential synergy between the Municipality and vulnerable communities, recognising the intrinsic interconnection between the city's ecosystems. By empowering these communities, not only environmental resilience is boosted, but also a direct positive impact on economic conditions is expected. These actions will be able to create proximity between the various stakeholders, benefiting the Municipality by receiving crucial data, allowing communities to actively participate in the climate transition and move closer to municipal opportunities. It shows that everyone is an integral part of a movement for sustainability, promoting a just transition towards this common goal: carbon neutrality by 2030.

By having a culture of innovation and co-creation settled in the city, to start to draft the portfolio of key actions to be included in the Porto's Climate City Contract, city stakeholders were invited to participate in a joint workshop organized together with the Net Zero Cities team in April 2023 (Figure 7) in which, for three days, municipal entities and partners of the Porto Climate Pact worked together on this topic. Dedicated to the strategic alignment between partners, the first day included the sharing of results achieved and objectives of several entities, including the Municipality of Porto, Misericórdia do Porto, Sociedade Transportes Colectivos do Porto (STCP), Centro Hospitalar Universitário São João, Fundação de Serralves, REN Portgás, LIPOR, Futebol Clube do Porto, Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial (INEGI), SONAE, Elergone Energia and Centro de Investigação do Território Transportes e Ambiente (CITTA)/ Faculdade de Engenharia da Universidade do Porto (FEUP). The remaining sharing moments were dedicated to identifying and assessing the city's diverse climate needs, especially focused on concrete measures to be developed, with a view to carbon neutrality by 2030. This event resulted in the creation of liaison points between the different stakeholders who have since established synergies. The workshop involved also the dynamization of actions related with the ASCEND project, one of the first projects financed by the HORIZON-MISS-2021-CIT-02-04 - Positive Clean Energy Districts, and which will boost the deployment of the first positive clean energy district in Porto.

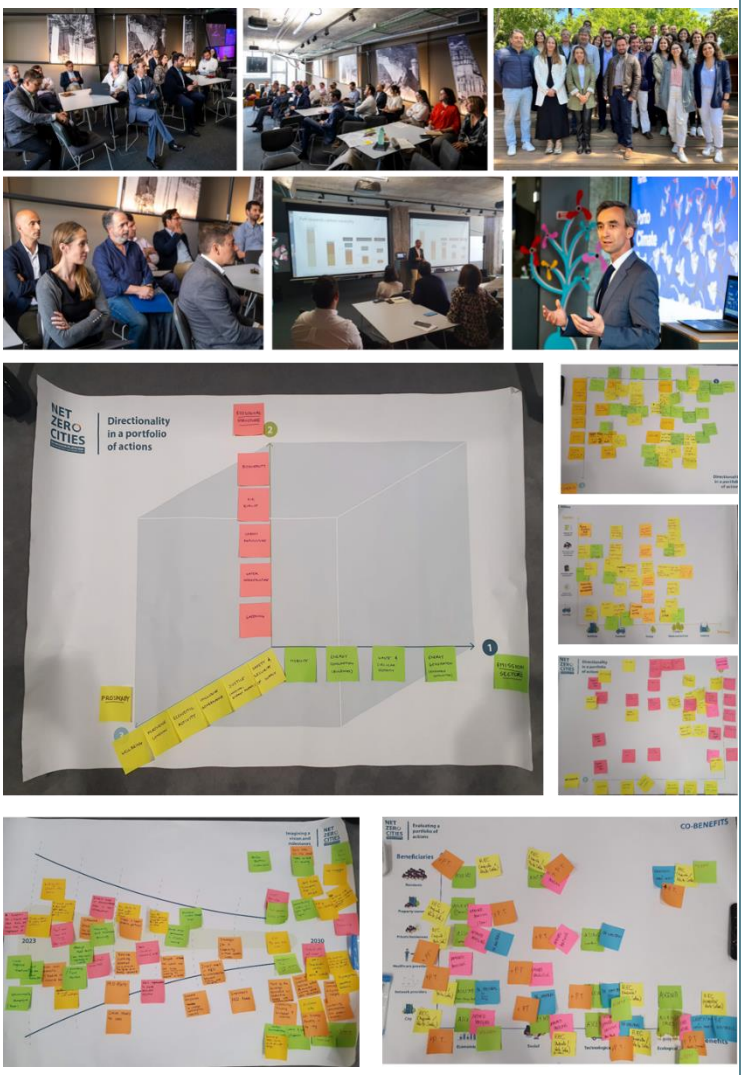


Figure 7. Workshop with stakeholders.

Also, directly in the scope of the Cities Mission participation, **to further strengthen Porto's climate mandate and since the city has an anchor role in the Porto Metropolitan Area, Porto has been participating in a network of Portuguese cities that aim to be carbon neutral**. Although only taking the first steps, this network is expected to encourage the exchange of experiences and good practices from a collaboration and mutual aid perspective. **The network was launched under the name "Network of Portuguese Cities and Regions for Climate Neutrality" and has already secured funding for its operation in 2024 from the Environmental Fund of the Ministry of Environment and Climate Action. This network includes Portuguese cities and regions committed to the transition to climate neutrality**. By taking on this leadership role, these cities and regions aim to implement climate actions, strengthen internal capabilities, and collaborate with stakeholders in order to move towards a sustainable and resilient society. The network currently comprises 21 cities and regions, and its initial selection was based on all Portuguese cities and regions that applied to the "100 climate-neutral and smart cities", even if they were not selected. The network currently has a technical secretariat provided by IN+ (Center for Innovation, Technology and Policy Research), which will serve the cities and regions that make up the Network to assist them with developing measures that contribute to climate neutrality, through knowledge, tools, and training. This network stems from good benchmark examples observed in other member states regarding the interaction between different cities working towards a common goal. Among these, we would highlight citiesES due to its proximity to Spain as a constituent country of the Iberian Peninsula and for participating in previous joint actions.

Figure 8. First formal presentation of the Portuguese Network of Cities and Regions towards Carbo Neutrality.

Under the organization of **CapaCITIES: Advancing national support for climate-neutral cities**, Porto is also involved in a closer national collaboration with the Mission Hub Policy Group, an initiative developed by the ANI (National Agency for Innovation), involving all the relevant public organizations within the ministries that deal with the relevant policy instruments that support the country and the cities to become carbon neutral. There is a cities' group to share experience, know-how and learnings in their work to achieve the goals of Cities Mission with these national and regional relevant stakeholders. National partner supporting the Cities Mission is the DGEG (Directorate General for Energy and Geology).

Table I-1.1: Climate Neutrality Target by 2030

Sectors	Scope 1	Scope 2	Scope 3
Stationary energy	Included	Included	Included
	No exclusions	No exclusions	No exclusions
Transport	Included	Included	Included
	No exclusions	No exclusions	No exclusions
Waste/wastewater	Included	Not applicable	Included
	No exclusions	Not applicable	No exclusions
IPPU	Included	Not applicable	Not included
	No exclusions	Not applicable	Not included
AFOLU	Sources not included (positive emissions)		
	Sinks included (negative emissions)		
Other	Not included	Not applicable	Not included
Geographical boundary	**Same as city administrative boundary**		

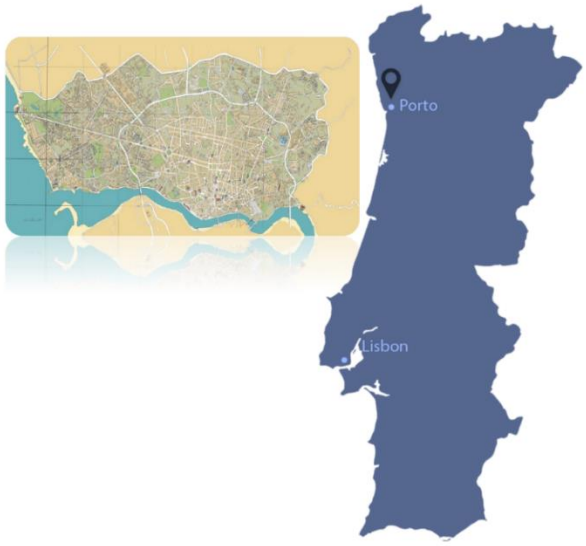
Map


Figure 9. Porto location.

2 Part A – Current State of Climate Action

2.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

GHG Emissions Baseline inventory

Reporting to 2004, established as the baseline year for GHG emissions in Porto's SEAP, **the city reduced its emissions in 38% by 2019 and 42% by 2021 (**Erro! A origem da referência não foi encontrada.**). This reduction trend has been steady over the years and is mainly driven by the electrification of energy use in buildings (residential and commercial) and the decarbonization of the national power system**. Also, this overall reduction is reflected into a significant reduction in the per capita figures which decreased 33% from 2004 to 2019 and 37% in 2021, compared to 2004. With this inventory as a basis for decision support, **the city is aware of the need to intervene on the decarbonization of buildings (stationary energy) and transports since these are the main GHG emitters, representing 51% and 42% of the total GHG emissions in 2019, respectively.** Moreover, this methodology allows the city to understand its direct (scopes 1 and 2) and indirect (scope 3) weight in emissions, which makes it possible to prioritize direct actions and to establish partnerships with other municipalities to act on the territory in a holistic way. AFOLU (Agriculture, forestry, and other land use) accounting is not included in Porto's GHG emissions inventory as no agricultural activities are developed in the city, which is a purely urban area.

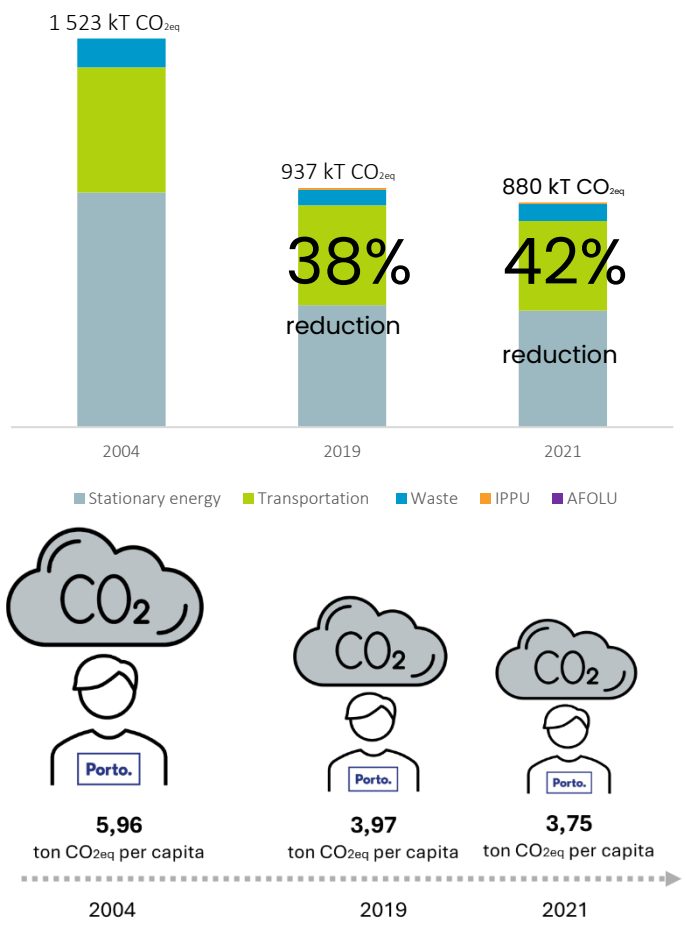


Figure 10. GHG emissions evolution (total and per capita).

The city's annual inventory is the basis for most of the city's strategies (e.g., SEAP and Municipal Climate Action Plan) and allows a clear identification of the gaps to achieve carbon neutrality in Porto: **Despite the positive evolution in terms of electrification, a considerable effort in building renovation (municipal facilities, social housing and incentives for privates) and a huge investment in sustainable mobility options (electrified bus fleet, new metro lines, free public transport), Porto still has a long way to go in terms of buildings and transports.** The strong local and national political will, as well as the existence of funding options (both from the Municipality and from funding programs as the Recovery and Resilience Plan) and a local Transition Team used to work collaboratively from some years are important enablers for Porto's decarbonization path. However, the need to massify private participation in the city climate action, both to raise awareness

and leverage private investment (crucial for building renovation, for instance) as well as the need for a profound behavioural and habit change regarding private transport and waste recycling rates are important barriers that Porto need to overcome in the coming years.

This inventory is annually updated by AdEPorto and has been carried out since 2009, endowing Porto with a detailed annual record of energy and GHG, which is key to periodical reports to initiatives such as the Covenant of Mayors[1] – subscribed by Porto in 2008 and updated in 2019 – and the CDP - Disclosure Insight Action – in which Porto has been awarded with class A in 2020, 2021 and 2022. This knowledge is crucial for the city as establishing an intelligible baseline is key to designing city policies and understanding how to act. Knowing where the city stands in terms of energy consumption and GHG emissions is decisive to develop a solid Climate City Contract Action and Investment Plans considering the actions being promoted by both the Municipality and by other city stakeholders.

BOX 3: Improvements to consider

This annual inventory is mostly based on data provided by national (i.e., DGEG) and metropolitan entities (Porto Metropolitan Area), but also on data from local actors (i.e., Metro do Porto, STCP, etc.). By being dependent on national and regional entities for data provision, the city GHG inventories have a delay of two years (i.e., data from 2019 were only made available in 2021 and so on). This issue occurs for the whole territory and an effort has been made to work with national entities to accelerate the access to consumption data. Another point to improve is related to mobility and transports. The information that allows measuring the modal split, as well as the origin-destination matrices results from a metropolitan mobility survey carried out over a period of 10 years (the last survey date of 2017). In this sense, and as a way of improving this crucial information, the municipality of Porto is discussing this issue at a metropolitan level so that the survey is carried out with a greater regularity. Finally, it should be noted that municipalities do not have a detailed characterization of how energy is consumed in buildings, especially in residential ones. Assumptions are made considering a National Household Consumption Survey - a national survey carried out every ten years and which can mischaracterize energy consumption in a purely urban environment, as is the case in Porto, since a large part of the Portuguese territory is semi-rural.

In an effort to improve these gaps in future iterations of the CCC, Porto hopes that, through its participation in the National Network of Cities and Regions for Carbon Neutrality (Figure 8), the sharing of technical knowledge (data, models and tools) and collaborations between and with interested parties, particularly with providers of crucial data, will allow the existing methodology to be improved. At the same time, members of the Transition Team, namely AdEPorto, will continue to work with national entities, such as ADENE, to also try to unlock and facilitate access to some data necessary for the local energy and emissions inventory.

Also, as the city has currently a consolidated characterisation of its direct emissions (scope 1 and 2) and since Porto is a purely urban territory, the Transition Team will now focus on assessing consumption-based emissions, namely the emissions produced by the consumption of goods and services (such as food, clothing, electronic equipment, etc.) by Porto residents. This area was not yet exploited by the team and represents the next logic step to have a better understanding of the city impact.

Since 2008, when Porto subscribed to the Covenant of Mayors, the city has been working on monitoring energy consumption and GHG emissions, developing and refining an assessment methodology. **Recently, to cover all GHG emission domains, the city updated its approach and adopted the City Inventory Reporting and Information System (CIRIS), developed by C40 Cities, as monitoring tool.** CIRIS is an accessible, easy-to-use, and flexible Excel-based tool for managing and reporting city GHG inventory data based on the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) standards. The tool facilitates and harmonizes the reporting of emissions for five sectors, namely: a) Stationary energy; b) Transportation; c) Waste; d) Industrial processes and product use (IPPU) and e) Agriculture, forestry, and other land use (AFOLU).

The methodology adopted is detailed in Annex 1 – Energy and GHG inventory methodology and the results are presented in Tables A-1.1 and A-1.3.

[1] https://www.globalcovenantofmayors.org/cities/european-union-and-western-europe/portugal/porto/

A-1.1: Final energy use by source sectors			
Base year	2019		
	Scope 1	**Scope 2**	**Scope 3**
Buildings	**711,18**	**1 202,52**	**140,68**
Electricity (GWh/year)		1 202,52	137,84
Natural gas (GWh/year)	405,59		2,84
Liquefied natural gas (GWh/year)	73,30		
Residual fuel oil (GWh/year)	131,48		
Diesel (GWh/year)	21,25		
Lubricants (GWh/year)	0,42		
Biomass (GWh/year)	51,61		
Solar thermal (GWh/year)	20,48		
Photovoltaic (GWh/year)	7,05		
Waste and Wastewater	**0,33**	**17,17**	**-**
Natural gas (GWh/year)	0,33		
Electricity (GWh/year)		17,17	
Liquefied petroleum gas (GWh/year)	0,000000086		
Liquefied natural gas (GWh/year)	0,000000248		
Industrial Process and Product Use (IPPU)	**27,27**	**-**	**-**
Lubricants (GWh/year)	26,61		
Bitumen (GWh/year)	0,06		
Solvents (GWh/year)	0,60		
Agricultural, Forestry and Land Use (AFOLU)	**-**	**-**	**-**
*	-	-	-
Transports	**891,97**	**25,61**	**554,55**
Electricity (GWh/year)		25,61	
Liquefied petroleum gas (GWh/year)	5,97		3,98
Liquefied natural gas (GWh/year)	60,05		
Gasoline (GWh/year)	207,08		138,05
Diesel (GWh/year)	618,87		412,52
Total	1 630,75	1 245,30	695,23

* Porto is a purely urban Municipality without agricultural and forestry activities.

Figure 11 and Figure 12 detail the energy consumption in Porto, per sector and energy vector. In 2019, the Municipality of Porto was directly responsible for the consumption of 3 430,60 GWh of final energy, a 28% reduction compared to 2004, the base year defined by the city in its SEAP and official reporting processes. In addition to this consumption, indirect consumption due to losses in the electricity transmission and distribution networks (137,84 GWh) and fugitive emissions resulting from the natural gas distribution infrastructure (2,84 GWh) should be considered, **totalling the 3 571,28 GWh presented in Table A-1.1.** Being a densely urbanized territory, stationary energy (consumption in buildings) and the transport sector are large energy consumers (1 913,7 GWh and 1 472,1 GWh, respectively[2]). Compared to 2004, these sectors have decreased their final energy consumption by 32% and 22% respectively, translating the increased efficiency of energy consumption in buildings and transports, the electrification of energy uses (such as electric water heating and cooking) and the modernization of mobility services, because of urban mobility policies. On the other hand, as a low-industrialized territory where solid waste is treated outside the city limits, energy consumption in

[2] Only Scope 1 and 2.

(IPPU) (27,3 GWh) and the collection and treatment of waste and wastewater (17,5 GWh) is not very significant.

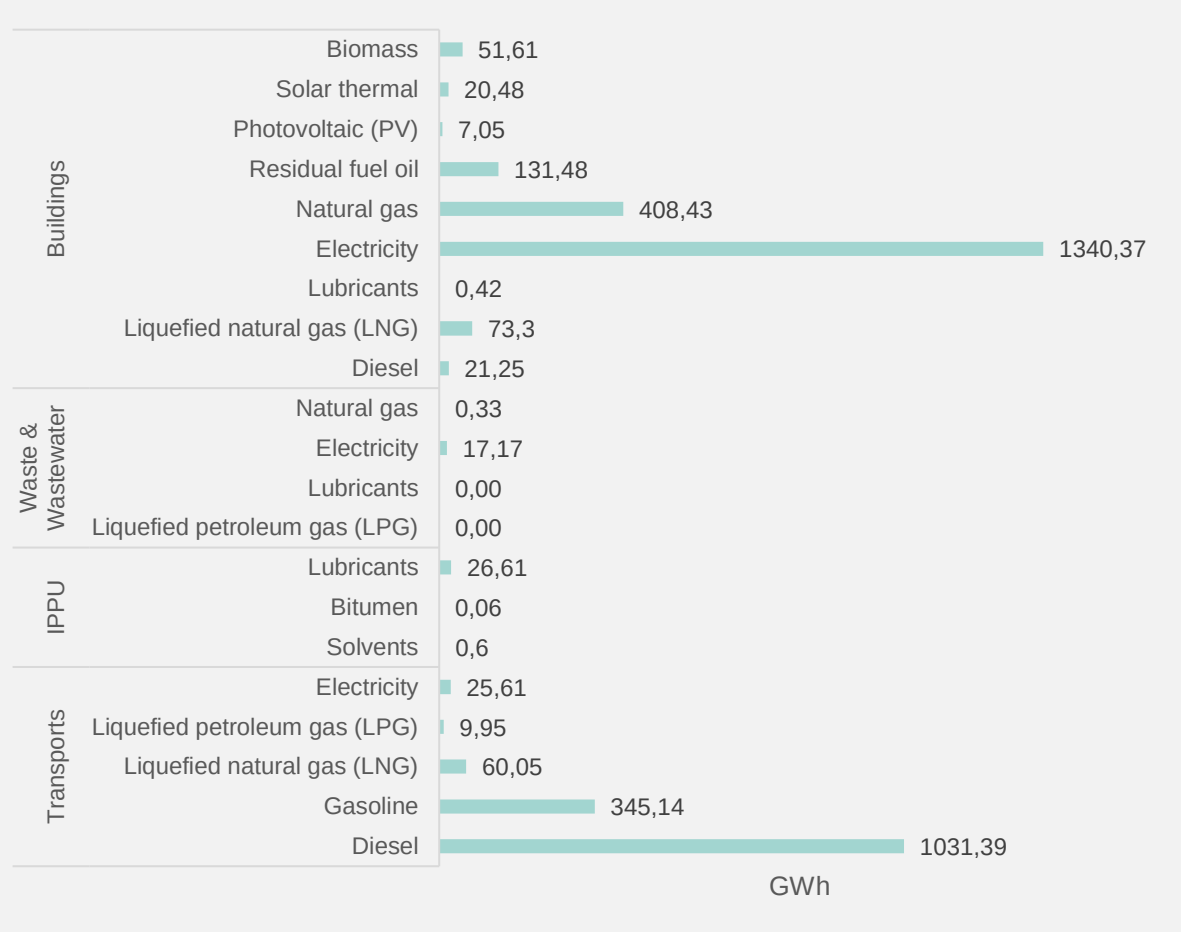


Figure 11. Energy consumption in Porto, per sector and vector, in 2019.

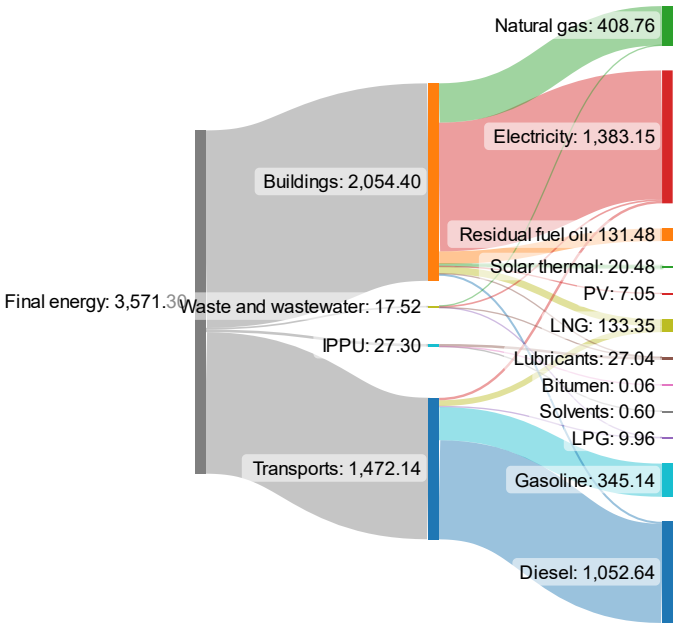


Figure 12. Sankey diagram of energy consumption in Porto, 2019.

In terms of energy vectors, those that contribute most to the overall final energy consumption in the Porto territory come from the stationary energy and transport sectors, due to the growing electrification of the former, and the weight of on-road transport in the Municipality's mobility. Thus, due to its predominance in buildings, electricity is the most used vector in the Municipality, followed by diesel. This is in fact a good starting point, as the decarbonization of the buildings sector is facilitated by the high level of electrification already taking place. However, the overwhelming dominance of diesel in the transport sector reveals the challenge of decarbonizing this sector.

Electricity is, therefore, the most used energy vector in the Municipality (39%), especially in Buildings (65% of the energy consumed in Porto's buildings is electric). Natural gas is the second most used vector in buildings (19,9%), and the third most consumed at municipal level (11%), as a result of its still widespread use for cooking and heating purposes (both hot water and spaces). Renewable sources, including biomass, solar thermal and solar photovoltaic energy, still account for only about 2% of the total energy consumed by of Porto's buildings. At the municipal scale, and because of the weight of the transport sector, diesel is the second most consumed vector in the territory (29%). Sectorally, diesel represents 70% of the energy consumption of on-road transports, followed by gasoline (23%). The consumption of natural gas in public transport (mainly due to the consumption of STCP buses) makes this vector the third most consumed in terms of road transport (4%), followed by electricity (2%), due to the existing rail transport (train and metro) network and the increasing electrification of road transport. The remaining sectors (Waste and Wastewater and IPPU), represent low energy consumption in Porto (0,5% and 0,8%, respectively), due to the low industrial presence in the city and the fact that Porto's waste is treated outside the city boundaries.

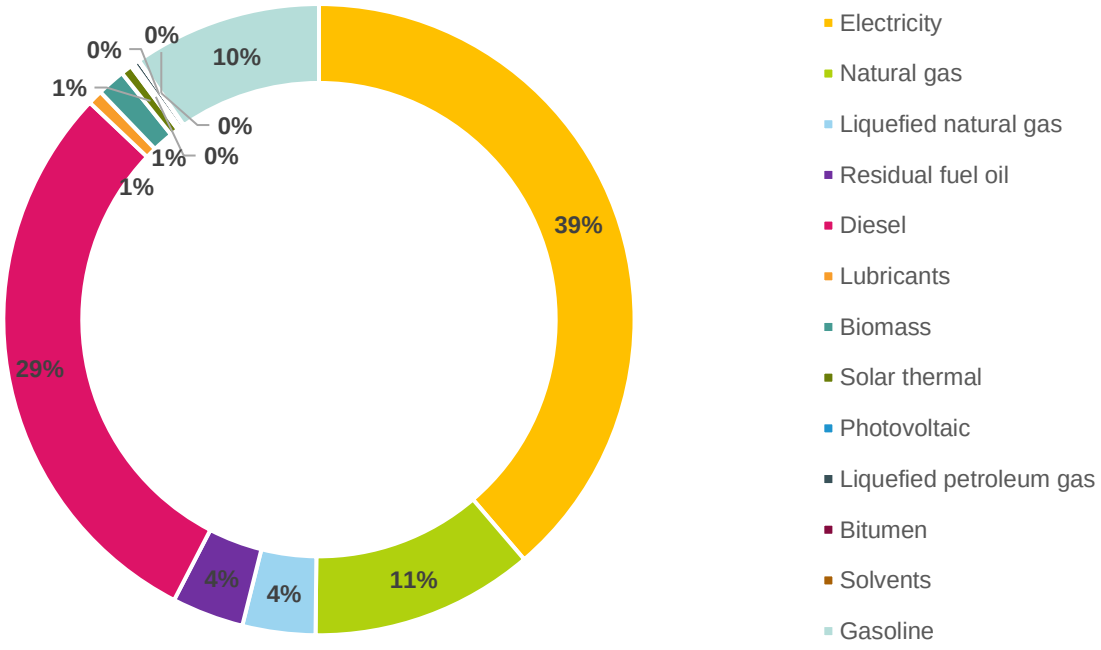


Figure 13. Energy consumption in Porto, per vector, in 2019.

After collecting the energy data, both the Global Warming Potential (GWP) and the emission factors were defined in CIRIS. For the GWP, the values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014) were considered as they reflect the most recent and advanced state of knowledge concerning the science of climate change. As for the emission factors, a mixed country-specific and local approach was used. For grid-supplied electricity, the annual carbon intensity factor of the national power system was assumed. This factor is annually provided by ADENE, the Portuguese Energy Agency, and available in the Portuguese Energy Observatory. In 2019, this value was 253 tCO_{2eq}/GWh. In turn, for the remaining energy vectors, the national Order 17313/2008 (Despacho n.º 17313/2008) establishes the Carbon Intensity factors for to the emission of greenhouse gases, expressed in kilograms of CO_2 equivalent ($kgCO_{2eq}$). These emission factors are the ones presented in section A-1.2. Finally, for waste, the local emission factors calculated by LIPOR, the managing entity responsible for waste collection for treatment in Porto, were used.

A-1.2: Emission factors applied

Sector	Primary energy/ energy source	Carbon Dioxide Equivalent (CO_{2eq})
Overall	*Electricity* (tCO_{2eq}/GWh)	253,00
	Diesel (tCO_{2eq}/GWh)	266,38
	Natural gas (tCO_{2eq}/GWh)	201,95
	LNG/LPG (tCO_{2eq}/GWh)	201,95
	Fuel oil (tCO_{2eq}/GWh)	278,28
	Lubricants (tCO_{2eq}/GWh)	263,88
	Paraffins (tCO_{2eq}/GWh)	258,48
	Gasoline (tCO_{2eq}/GWh)	249,12
	Bitumen (tCO_{2eq}/GWh)	290,16
	Biological treatment (waste) (tCO_{2eq}/tonne)	0,17
	Incineration (waste) (tCO_{2eq}/tonne)	0,53
	Wood/biomass (tCO_{2eq}/GWh)	0,00

	Photovoltaic (tCO_{2eq}/GWh)	0,00
	Solar thermal (tCO_{2eq}/GWh)	0,00
Transports-specific	*Passenger cars + motorcycles (g/km)*	154,00
	Buses (g/km)	618,00
	Light duty trucks (<3.5 t) (g/km)	633,00
	Heavy duty trucks (>3.5 t) (g/km)	1168,00
Building-specific	*Heat production (district heating) (g/kWh)*	200,00
	Heat production (local heating) (g/kWh)	207,00

Regarding GHG emissions, in 2019, the Municipality was responsible for the emission of 937,010 tCO_{2eq}, an overall reduction of 38% compared to 2004 (Table A-1.3 and Figure 14). Table A-1.4 presents additional relevant data used to compute the city GHG emissions.

A-1.3: GHG emissions by source sectors						
Base year		2019				
Unit		tCO_{2eq}				
		Scope 1	**Scope 2**	**Scope 3**	**Total**	**% of Total**
Buildings		138 572	304 239	34 874	477 685	51,1%
Transport		240 567	6 479	145 083	392 128	41,9%
Waste		8 257	-	51 477	60 004	6,4%
Industrial Process and Product Use (IPPU)		7 193	-	-	7 193	0,8%
Agricultural, Forestry and Land Use (AFOLU)	Sources (positive emissions)	-	-	-	-	-
	Sinks (negative emissions)				-1 355	0,1%
Total		**394 859**	**310 717**	**231 433**	**937 010**	**100%**

A-1.4: Activity by source sectors.			
Base year	2019		
	Scope 1	Scope 2	Scope 3
Buildings & Heating			
Heating demand in residential and commercial buildings (space heating + domestic hot water) (GWh/year)	694		
Transport			
Transport need – passenger cars + motorcycles (Mkm/year)	481		321
Transport need – buses (Mkm/year)	26		
Transport need – train/metro (Mkm/year)	7		
Transport need – light duty trucks (<3.5t) (Mkm/year)	18		12
Transport need – heavy duty trucks (>3.5t) (Mkm/year)	74		49
Waste			
Collected paper and cardboard within city boundaries (tonnes)	14 643,03		
Collected metal within city boundaries (tonnes)	2 508,49		
Collected plastics within city boundaries (tonnes)	19 247,33		
Collected glass within city boundaries (tonnes)	10 952,25		
Collected organic waste within city boundaries (tonnes)	52 680,66		

Collected other waste (e.g. textiles, rubble, wood, etc.) within city boundaries (tonnes)	46 296,45		
Solid waste disposal – Waste sent to landfills (tonnes)			2 665
Biological treatment – Organic waste valorisation (tonnes)			12 127
Incineration – Waste incinerated (tonnes)			90 103
Electricity			
Electricity demand within city boundaries (GWh/year)		1383,1	

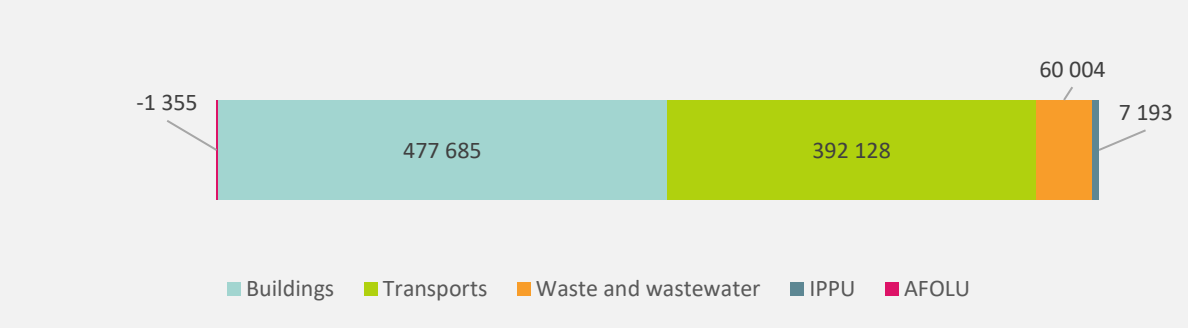
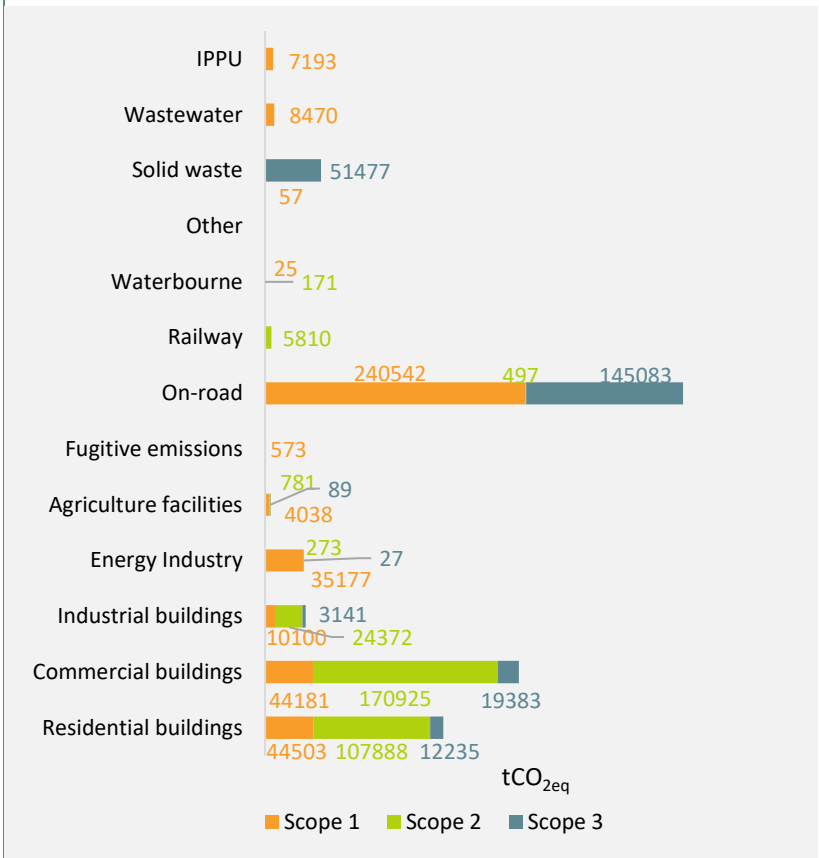


Figure 14. GHG emissions in Porto, 2019.



As the most intensive sector in terms of energy consumption, buildings (stationary energy) are also the main source of GHG emissions in Porto (477 685 tCO_{2eq}), closely followed by transports (392 128 tCO_{2eq}) and waste (60 004 tCO_{2eq}). As explained above, Porto is not an industrial territory, which is clearly reflected in the GHG emissions associated to IPPU. In addition, Porto is a densely built-up area, and although urban green areas cover more than 1/3 of Porto's surface, recent studies[3] estimate that the tree cover corresponding to the green area has a carbon sequestration potential of around 650 kg/ ha/year, which corresponds to a carbon sequestration capacity of around 1 355 tons/ year.

[3] Graça, M., et al., Assessing how green space types affect ecosystem services delivery in Porto, Portugal, Landscape and Urban Planning, Volume 170, 2018, pp. 195-208, https://doi.org/10.1016/j.landurbplan.2017.10.007

Figure 15. GHG emissions in Porto, by subsector and scope, 2019.

By examining the matrix of emissions by scope, the dichotomy between scope 1 (emissions occurring within the city) and scope 3 (emissions occurring outside, but by action of the city) in road transport stands out. This dichotomy characterizes the daily commuting movement to and from the city. Additionally, the significant electrification of energy uses in residential, commercial, and industrial buildings and facilities is represented by the preponderance of scope 2 emissions in these subsectors (Figure 15).

2.2 Module A-2 Current Policies and Strategies Assessment

A-2.1: Description & assessment of policies

There are multiple levels of policies, strategies, programs, and regulations that impact, directly and/or indirectly, Porto's 2030 climate neutrality ambition. These documents, as well as their relationship are displayed in Figure 16 and detailed as follows.

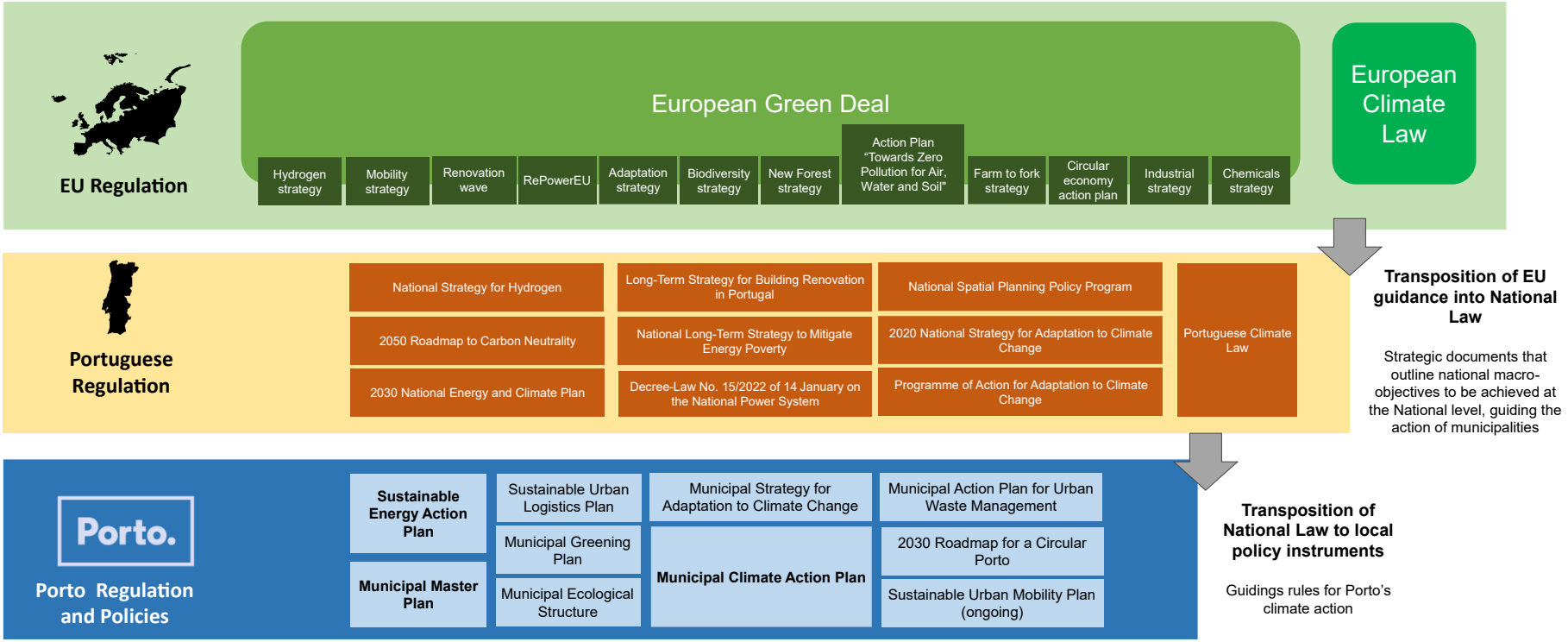


Figure 16. Existing policies and strategies affecting Porto's climate neutrality ambition and link between them.

At the **European level**, the **European Green Deal** and the **European Climate Law** pushed by a policy crisis, characterized by the interplay between the COVID-19 pandemic, the invasion of Ukraine, the energy crisis, the housing affordability crisis and the climate crisis, are the main drivers for the EU climate agenda. In line with these two documents and proposed under the scope of the Green Deal, the following complementary strategies and regulations must be considered as they set targets for different carbon-related dimensions:

- The **2030 EU Biodiversity strategy** (May 2020) seeks to make our societies more resilient to future threats, such as the effects of climate change, forest fires, food insecurity and disease outbreaks (particularly focusing on wildlife protection and combating its illegal trade).
- The **Farm to Fork Strategy** (May 2020) has food security as a priority and sets main objectives to ensure affordable and nutritious food within the limits of the planet production capacity.
- The **European industrial strategy** (March 2020, updated May 2021) supports the twin transition to a green, sustainable, digital, and resilient economy, making EU industry more competitive globally, and enhancing Europe's open strategic autonomy.
- The **Circular economy action plan** (March 2020) aims to accelerate the transition of the EU economy to a model in which economic activities are not dependent on the extraction of raw materials and the production of waste, but which promotes the re-use of materials within the EU itself and seeks to reduce external dependency on materials.
- The **EU Hydrogen Strategy** (July 2020) aims to develop clean, renewable hydrogen, produced using mainly wind and solar energy as the most compatible option with the EU's climate neutrality goal in the long term.
- The **Chemicals strategy** (October 2020) is part of the EU's zero pollution ambition and aims to better protect citizens and the environment from harmful chemicals and boost innovation by promoting the use of safer and more sustainable chemicals.
- The **Renovation wave** (October 2020) seeks to improve the energy performance of buildings across the EU, promoting energy efficiency and sustainability.
- The **Mobility Strategy** (December 2020) is a comprehensive strategy to meet a target to reduce transport-related greenhouse gas emissions by 90% by 2050 and ensure that the EU transport sector is fit for a clean, digital and modern economy.
- The **EU Adaptation Strategy** (February 2021) sets out how the EU can adapt to the unavoidable impacts of climate change and become resilient to climate change by 2050. The strategy has four main objectives: to make adaptation smarter, faster, and more systemic, and to strengthen international action for climate resilience.
- The **EU Action Plan "Towards Zero Pollution for Air, Water and Soil"** (May 2021) is a key deliverable of the European Green Deal, to better prevent, remedy, monitor and report on air, water, soil, and consumer products pollution.

- The **New Forest strategy 2030** (July 2021) aims to increase the size and quality of Europe's forests and improve their resilience to challenges such as climate change, while supporting communities whose livelihoods depend on forestry.

- The **REPowerEU** (May 2022) is helping the EU save energy, produce clean energy, and diversify its energy supply sources and is focused on the continued delivery of new national REPowerEU chapters under the updated Recovery and Resilience Facility; boosting industrial decarbonization; sign-off and implementation of new legislation for faster renewables roll-out; investments in energy infrastructure and interconnections; regulatory measures to increase energy efficiency; a modern regulatory framework for hydrogen, and a hydrogen accelerator.

- The **EU Solar energy strategy** (May 2022) is a relevant part of the REPowerEU plan as it aims to bring online over 320 GW of solar photovoltaic by 2025 (more than doubling compared to 2020) and almost 600 GW by 2030.

In addition to the Green Deal strategies and regulations, other important European initiatives include:

Smart Cities and Communities Initiative
Promotes the development of smart, sustainable urban areas by integrating technology and data to enhance efficiency and reduce environmental impact.

Covenant of Mayors for Climate and Energy
A voluntary commitment by local and regional authorities to exceed the EU's climate and energy targets.

European Climate Pact
Engages citizens, communities, and organizations in climate action, fostering collaboration and sharing best practices.

At the **national level**, Portugal has declared a state of climate emergency and has set objectives for the adoption of a mature and assertive climate policy, strengthening the principles of sustainability, cooperation, information, participation, prevention, and accountability, with the right to climate balance being enshrined as a constitutional right, where everyone has the right to a human, healthy and ecologically balanced living environment. The **National Spatial Planning Policy Program (PNPOT) 2020** identifies climate change and risks as one of the 18 land-use planning problems.

The exercise of the right to climate balance confers the power to require public and private entities to comply with the duties and obligations to which they are subject in relation to climate issues, namely regarding GHG emission reduction targets set out in the **Portuguese Climate Law (LBC)**. As currently drafted, LBC establishes the need to mitigate the impacts of climate change (promoting the adoption of adaptation measures and increasing resilience to climate change) and to achieve decarbonization targets, without considering the contribution of land use and forests to offset emissions. According to the LBC, Portugal must decrease its GHG emissions by at least 90% by 2050, with interim targets of at least 55% by 2030 and 65-75% by 2040, compared to 2005. In line with the climate goals and decarbonization targets, Portugal has been developing climate policies with a view to climate balance since 2018, when it developed its **2030 National Energy and Climate Plan (PNEC 2030).** This strategic document has become the country's main energy and climate policy instrument, proposing guidelines for 2030 by focusing on renewable energy and energy efficiency as tools for decarbonizing the economy and the energy transition. The PNEC 2030 sets a target of up to 47% renewables in the energy mix, aiming to make more and better use of endogenous resources and diversify energy sources to achieve greater energy independence for the country. The sun, wind, rivers, waves, and biomass are natural resources that can and should become cheaper and more accessible forms of energy production, helping to reduce costs

and increase competitiveness for businesses and household budgets. Promoting vehicle electrification, strengthening active, soft, shared, and connected mobility, and improving the supply and quality of public transport are all important in reducing emissions by improving mobility. Also, the PNEC 2030 is based on a fair, democratic and cohesive model of transition, ensuring that opportunities are available and enjoyed by all in an equitable and inclusive manner, and that the most vulnerable are defended and protected. These assumptions are essential for the development of a decarbonized, more competitive, and fairer economy capable of generating jobs, wealth, and prosperity in line with the national goal of achieving carbon neutrality by 2050.

Indeed, in 2019, Portugal published its **2050 Roadmap to Carbon Neutrality (RNC2050)**, which sets out the long-term strategy for a sustainable, zero-carbon economy by 2050. The RNC2050 brings together a range of energy and mobility policies that can reduce GHG emissions by around 85 per cent compared to 2015 and increase carbon sequestration by expanding and strengthening the ecosystem services provided by land use and forestry to offset the 15 per cent of remaining emissions.

For the decade 2021-2030, the entry into force of the following strategies and regulations leading to decarbonization in Portugal should also be highlighted:

- **National Strategy for Hydrogen** (EN-H2) - Promotes the use of hydrogen in the various sectors of the economy, creating the necessary conditions for the establishment of a true hydrogen economy in Portugal.

- **Long-Term Strategy for Building Renovation in Portugal** (ELPRE PT) - Aims to promote the energy efficiency of existing buildings with a view to transforming them into Nearly Zero Energy Buildings (nZEB).

- **National Long-Term Strategy to Fight Energy Poverty (ELPCPE PT)** - Aims to reinforce the importance of achieving the indicative targets for the decades 2030, 2040 and 2050, which aim to address issues related to energy poverty and improve the quality of life of citizens.

- **Decree-Law No. 15/2022 of 14 January** - Regulates the operation of the national electricity system in accordance with the European Union directives on the internal electricity market and the promotion of renewable energy. This law incorporates the provisions on renewable self-consumption (and repeals Decree-Law no. 162/2019, of 25 October) and establishes the regulatory framework for the creation of renewable energy communities, citizen energy communities and renewable self-consumption projects.

Regarding climate adaptation, the **2020 National Strategy for Adaptation to Climate Change (ENAAC)** was launched in 2015 and will run until 2025. It establishes the model for the implementation of adaptation solutions for different sectors of activity and defines the objectives of adaptation as improving knowledge on climate change, implementing adaptation measures, and promoting the integration of adaptation in sectoral policies and instruments. In order to complement and systematize the results of the ENAAC, the **Programme of Action for Adaptation to Climate Change (P-3AC)** has been developed, one of the aims of which is to achieve the second objective of the ENAAC, i.e. to implement adaptation measures, particularly with regard to physical interventions that have a direct impact on the territory. In this context, the P-3AC identifies and brings together a series of actions that are considered priority to reduce the vulnerability of the national territory and to increase the resilience of natural and human systems, with a view to promoting the well-being of the population, especially the most vulnerable groups.

The decarbonization of the Portuguese power system foreseen in the RNC2050 has a significant impact on GHG emissions reduction expected by 2030. Alongside, the penetration of green hydrogen in the natural gas distribution network forecasted in the National Strategy for Hydrogen has also a considerable impact on the city decarbonization. Together, these two measures are expected to avoid the emission of over 289 $ktCO_{2eq}$ by 2030. Also, the sociodemographic scenarios of the 2050 Roadmap to Carbon Neutrality as well as its assumptions regarding consumption trends in buildings (including industry) and transports, as well as waste management estimates, were used to compute a Business-as-Usual (BaU) scenario for Porto in 2030. This BaU is used for target setting and the assumptions considered (population, gross value added, etc.) are not double counted in further estimations.

At the **local level**, in the specific context of climate change mitigation, the Municipality of Porto signed the **Aalborg Charter** (2006) and the **Covenant of Mayors** (2008), an initiative launched in Europe in 2008 with the aim of bringing together local governments voluntarily committed to meet and exceed the EU's climate and energy targets. The Municipality committed to reduce the city's GHG emissions by 45% between 2004 and 2020, implementing common approaches to decarbonization and adaptation to climate change. In 2019, Porto, as part of a group of 12 European cities, once again signed the **Covenant of Mayors for Climate and Energy**, this time committing to voluntarily reduce carbon emissions by 60% by 2030. In line with the Covenant of Mayors commitment, in 2021, Porto approved its **SEAP** which details the relevant actions to mitigate climate change, both on the initiative of the Municipality and other stakeholders, which together will contribute to the objective of reducing GHG emissions. Also, since 2016, the Municipality has in place its **Municipal Strategy for Adaptation to Climate Change**. This strategy includes 52 adaptation measures, most of which are already underway. Porto's commitment to these issues is also reflected in its membership to the CDP - Disclosure Insight Action, which provides companies and cities with the world's largest information system for measuring, disclosing, and managing their environmental impacts and strategies resulting from actions taken to mitigate, decarbonize and adapt to climate change. Porto has been recognized as a CDP A-List city for 2020, 2021 and 2022. Currently, to answer the national Climate Law requirements and update its climate goals, the **Municipal Climate Action Plan** is under development and will be aligned with this Action Plan to ensure a comprehensive guidance towards carbon neutrality.

Figure 17. Porto's SEAP (above) and Municipal Climate Change Adaptation Strategy (below).

To ensure an integrated view of the city and a comprehensive spatial planning, reference should also be made to the **Municipal Master Plan** (PDM) of Porto, approved in June 2021 and already in implementation, focuses on five guiding axes:

Environment and Quality of Life: This component of the plan includes:

- The definition of the environmental city system considering the existing natural risks, the "green" and "blue" structures of the territory and the acoustic zoning.

- The valorisation of the municipal ecological structure as a fundamental element of the territory, defined considering the green areas with public access, the green areas with high ecological value, the green corridors along the existing water lines, the alluvial areas and the network of ecological connection providing green corridors along the city's main canal spaces.

- The densification of the city's green structure, including:

    - Doubling the green area of public access through the creation, expansion or requalification of public parks and gardens;

    - The definition of the green system including spaces associated with urbanizations, publicly or privately owned, with public access;

    - The afforestation of the city's structuring streets;

    - The creation of incentives with reduced fees for operations that vacate the interior of blocks, making them permeable green spaces;

    - The creation of incentives with reduced fees for operations that promote the public use of private spaces in the central area of the city;

    - The creation of an incentive system that positively discriminates against operations that contribute to the Municipality's environmental policy.

Within this scope, the **Municipal Ecological Structure** has as its main objective the improvement of the urban space through the preservation and integration of green and natural spaces, recognized as an essential tool to promote the resilience of the territory in the face of climate change. In turn, the **Municipal Greening Plan**, presented on 17 May 2023, is a strategic document whose main objective is to improve the sustainable public greening of the city of Porto, created with the aim of materializing and implementing, at a finer and more programmatic scale, the vision of the municipal ecological structure included in the PDM revision process. Urban greening, in this case through trees, is particularly important because of the bioclimatic benefits - regulation of thermal and hydrological cycles, release of oxygen, carbon sequestration, trapping of pollutants, etc. - and the opportunities for maximizing biodiversity that it offers.

Figure 18. Porto's Greening Plan.

Building and Housing: This component of the plan focuses on:

- Functional balance and territorial cohesion, through mitigating the excessive concentration of activity in the city centre by distributing urban loads, as well as strengthening the network of collective facilities.

- The expansion of areas with type-morphological criteria for buildability.

- Strategic densification, through the adjustment of building rates, increased for the construction of accessible or social housing and also with the creation of new areas of economic activity.

- The creation of inclusive zoning, which provides those urban operations with a relevant building area, located in the city centre, allocates a percentage of their area to affordable housing.

To accelerate the renovation of buildings and transform them into renewable energy hubs, Porto has launched several initiatives. The city has in place several municipal incentives, both for housing renovation - exemption from municipal taxes in the case of improving the energy efficiency of housing - and for renewable energy production (regulation in public consultation).

Mobility and Transport: This component of the plan includes:

- Reinforcing the focus on public transport, with the definition of a structuring network consisting of high-quality bus lanes, circular corridors and radial axes.

- Changing the current paradigm in private parking policy, introducing maximum sizing criteria for non-residential uses in the Historic Centre, Downtown and in the areas influenced by existing and planned metro stations.

- The creation of “Zones XXI”, where the aim is to progressively eliminate parking in public spaces and along streets, replaced by parking for residents in existing or upcoming collection garages.

- The definition of the fundamental structure of the circulation network intended for smooth modes.

- The creation of pedestrian zones in the Historic Centre of Porto.

Within this scope, the **Sustainable Urban Logistics Plan (PLUS)**, approved in November 2021 and already in implementation, is a relevant integrated strategic plan that defines an integrated strategy for regulating logistics activities in the city of Porto.

Figure 19. Porto's Sustainable Urban Logistics Plan.

Economy and Employment: This component of the plan provides:

- The creation of areas of economic activity defined in the land qualification charter, corresponding to new areas of work and urban identification.

- The strategic densification of specific areas of the city.

- The reduction of urban taxes on operations that promote street commerce.

- The enhancement of the role of university campuses as catalysts for territorial transformation.

Identity and Heritage: This component of the plan, with great value for the city given its tourist nature, foresees:

- The promotion of the Historic Centre and central areas as major references for the urban development of the metropolitan agglomeration.
- The creation of a systematized database of protected properties to be preserved, consisting of a set of more than 1000 sites.
- The preservation of the identity of urban places, in addition to individual properties, considering the urban fronts, forms of coverage, physical geography, elements of urban identification, vegetation cover, among others. To this end, specific rules were created for areas of urban and architectural interest, for complexes and properties with heritage value and for historic centres and places.
- Strengthening the protection of protected areas, with a more geographically contained delimitation but with a more densified identification of the values to be protected and more objective and concrete protection criteria.
- The incorporation of the protection of stores, establishments and entities recognized within the scope of the municipal program “Porto de Tradição”.

The objectives for each PDM main topic are detailed in a dedicated **website**, which also provides all documentation related to the review process.

Urban waste management and the cleaning of public spaces are essential public services for the population, being directly related to the defence of the environment, public health, collective security, economic development and, in general, improving the quality of life of citizens residing in the city of Porto. Transposing a set of European directives into the national law, ambitious targets regarding the reuse and recycling of waste, new obligations regarding the selective collection of bio-waste and other fractions, as well as other equally relevant measures such as the banning of waste that could be recycled or recovered to landfill, are being discussed. Committed to achieving the objectives set by the legislator, including in the National Waste Management Plan approved in March 2023, the Municipality is also now preparing its **Municipal Action Plan for Urban Waste Management (PAPERSU)**. Finally, Porto also has a long-lasting tradition in circular economy, which is one of the key themes in the medium and long-term municipal strategy for Porto's environment. The city wants to increasingly contribute to the regeneration of ecosystems, to the recycling and reducing of waste, to the reuse of by-products as a resource for other processes (for example, treated wastewater), to the involvement of companies, consumers, and other actors in the sector in reflecting on the steps that each one must take in this direction. Porto has been putting a substantial part of its effort into very concrete actions, some of which are reflected in the **2030 Roadmap for a Circular Porto**, drawn up in 2017. This document, prepared with the collaboration of several active people and organizations in the city, highlights the main practices and projects taking place while proposes a long-term vision and identifies opportunities and concrete actions to transform Porto into a circular city in 2030.

The climate emergency has fuelled the city's desire to achieve even bolder goals and in 2021 Porto announced its willingness to become carbon neutral by 2030. This motivation derived the selection of Porto as one of the 100 European carbon neutral Mission Cities. Achieving climate neutrality by 2030 and forestalling the national and European targets by 20 years has become Porto's new goal. To assist the carbon neutrality journey, on 31 January 2022, Porto launched the **Porto Climate Pact**. This initiative is based on the principle that the path to carbon neutrality in Porto is demanding and requires collective action for collective benefit. Carbon neutrality in Porto can only be achieved through concrete actions by all actors, regardless of their size, past actions, or legal personality. Porto believes that a common vision and goal for decarbonization can help all actors move in the same direction to achieve a common goal. That is why the Porto Climate Pact aims to stimulate action among citizens and organizations, creating a large community of learning, sharing and mutual support.

Currently, Porto Climate Pact is managed by the city Transition Team and works as an umbrella for all neutrality-related actions occurring in the city, meaning that all the progresses being made in the plans presented previously are followed, supported, and monitored by this team. Thus, the portfolio of measures proposed in this Action Plan are aligned with the city current guiding documents, namely its SEAP, the Sustainable Urban Logistics Plan, the Municipal Master Plan, the Municipal Greening Plan, and the Municipal Action Plan for Urban Waste Management.

Together, these measures are expected to avoid the emission of over 416 $ktCO_{2eq}$, as presented in table A-2.1. Considering as starting point the BaU baseline emissions and the emissions reduction achieved through national policies (namely the decarbonization of the national power system as well as the penetration of hydrogen in the natural gas distribution network forecasted by the 2050 Roadmap to Carbon Neutrality (RNC2050) and the National Strategy for Hydrogen, respectively), bold emission reduction targets were set up for buildings (-98%), transport (-78%) and waste (-40%). Also, a 140% increase target was set up for carbon sinking. Although ambitious due to the reduced available area for green spaces in the city, this carbon sink target is still insufficient to compensate residual emissions.

Overall, Porto is committed to an 85% emissions reduction target by 2030. As presented below in table A-2.1, this means that the percentage of emissions reduction previously planned through other Action Plans in progress represents 35% of this target, while the rest of the emissions reduction expected through this CCC Action Plan represents 50%**. Therefore, 416 $ktCO_{2eq}$ represents the emissions gap which will be addressed through the comprehensive portfolio of actions defined in the CCC**. Still, a 123 $ktCO_{2eq}$ of unavoidable residual GHG emissions are estimated by 2030 mainly due to the difficulty of provoking a deep change in the way people use transports – Porto is a large urban centre (for Portugal) and is one of the most congested cities on the Iberian Peninsula – and the difficulty of sequestrate carbon due to the highly urbanised territory.

A-2.1: City emission gap and residual emissions											
	(1) Baseline emissions	**(2) Emissions Reduction Target 2030**		**(3) Emission reduction through other Action Plans**		**(4) Emissions Gap**		**(5) Emissions reduction through the CCC Action Plan to address the Gap**		**(6) Residual emissions**	
	Business-as-Usual 2030 scenario	The emissions reduction target defined by Porto for 2030 is 85%.		The effects of the decarbonization of the national power system (as forecasted in 2050 Roadmap to Carbon Neutrality (RNC2050)), the injection of green hydrogen in the natural gas distribution network (as projected by the National Strategy for Hydrogen) as well as the city greenification (already ongoing) as predicted by the Municipal Greenification Plan are considered in this column. These actions are not accounted in the action portfolio in section B neither in the BAU scenario modelling.		(4) = (2) – (3)		This column presents the quantified emission reduction associated with the action portfolios outlined in module B-2.		(6) = (1) – (2)	
	(absolute) (tCO_{2eq})	(absolute) (tCO_{2eq})	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)
Buildings	435 309	426 549	98%	278 759	64%	147 790	34%	147 790	34%	8 760	2%
Transport	328 078	256 306	78%	6 974	2%	249 332	76%	249 332	76%	71 772	22%
Waste	58 842	23 600	40%	3 870	7%	19 730	34%	19 730	34%	35 243	60%
Industrial Process and Product Use (IPPU)	7 193	0	0%		0%	0	0%		0%	7 193	100%
Agricultural, Forestry and Land Use (AFOLU)	-1 355	-1 895	140%	-1 381	102%	-514	38%	514	38%	540	-40%
Total	**828 067**	**704 559**	**85%**	**288 222**	**35%**	**416 337**	**50%**	**416 337**	**50%**	**123 507**	**15%**